COSTAWARE METHODOLOGY

Delaware Health Care Commission

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Delaware *CostAware* Data Sources and Methodology

Overview

The Delaware Health Care Commission (DHCC) is reporting estimates of the average cost of health care services for state residents generated based on data from the Health Care Claims Database (HCCD), a robust source of data for Delaware residents that includes claims submitted by the state's largest health insurance payers.

Cost estimates reflect the average amounts paid by the payer and the patient based on analysis of claims data from the HCCD. Cost estimates reflect both insurance payments and patient payments including copay, coinsurance, and deductible amounts.

The purpose of the *CostAware* website is to summarize results of these cost analyses and highlight variation in payments for medical services in Delaware. Many factors contribute to health care cost variation including differences in clinical practice, billing practices, contractual relationships, and the payment systems used by health insurers. *CostAware* does not yet explore how these sources of variation impact Delaware's medical costs. In addition to cost analyses, *CostAware* also reports utilization measures for services where meaningful and appropriate. Quality measures were generated by the Centers for Medicare and Medicaid Services (CMS) from data reported by hospital systems and Accountable Care Organizations (ACO) operating in Delaware.

The initial April 2022 launch and this version 2.0 update to *CostAware* are important steps toward increasing the transparency of the Delaware health care system. Improving health care transparency is a direct outgrowth of Governor John Carney's 2018 Executive Order 25, which established health care cost and quality benchmarks in Delaware. Understanding variation in cost, utilization and quality is necessary to identify opportunities to improve patient experience and population health and identify opportunities to control health care costs and the rate of growth. These are Delaware's goals related to the Triple Aim.

This document provides an overview of the HCCD database, and the methods used to generate the cost, utilization, and quality measures reported on *CostAware*.

Data Source: The Delaware Health Care Claims Database (HCCD)

The Delaware Health Care Claims Database (HCCD) is powered by the Delaware Health Information Network (DHIN). The HCCD is a collection of health care claims, enrollment, and provider data from Medicare, Medicaid, and some of the larger commercial health insurers operating in Delaware. It is Delaware's All-Payer Claims Database (APCD) and the largest repository of claims data with over nine years of data for more than 800,000 Delaware residents. Visit the APCD Council website to learn more about APCDs from a national perspective.

The purpose of the HCCD is to facilitate data-driven, evidence-based improvements in access, quality, and cost of health care. The HCCD is a tool to promote and improve public health through increased transparency of claims data and information. The HCCD can also help lawmakers and decision makers identify areas for quality improvement and expanded access; understand and quantify health system performance and the impact of health care transformation; and provide meaningful comparisons and other actionable information to support policy and consumer decisions. The Delaware General Assembly

passed legislation in State Fiscal Year 2016 authorizing the Delaware Health Information Network to develop a health care claims database.

For more information on DHIN and the HCCD visit: Delaware Health Care Claims Database - Delaware Health Information Network (dhin.org).

Definitions and Acronyms

- ***ACO:*** Accountable Care Organizations are voluntary groups of doctors, hospitals and other health care providers who work together to provide coordinated, high-quality care to their patients. The ACO establishes financial incentives for providers to promote best practice care to the right persons at the right time while improving patients' overall health care experience. The ACO initiative is a major piece of Delaware's Road to Value. For more information on the Road to Value, visit: https://www.choosehealthde.com/Road-to-Value.
- ***CC / MCC****:* Complications or Comorbidities / Major Complications or Comorbidities. Used most often with Diagnostic Related Groups (see MS-DRGs)
- ***CMS****:* The Centers for Medicare & Medicaid Services
- ***CPT Codes****:* Current Procedural Terminology (CPT) codes developed and maintained by the American Medical Association (AMA) and used as a standard to identify and categorize medical procedures.
- ***EID:*** The anonymous DHIN assigned Enterprise Identifier (EID) for individuals in the HCCD database. EIDs are assigned using DHIN's IBM Initiate person matching process.
- ***Episode:*** A *CostAware* episode includes all the health services that are provided during an inpatient stay. The inpatient stay is identified using several elements including: admission date, discharge date, and hospital care setting. Episodes capture the costs of all health care services associated with an inpatient stay, regardless of the billing provider. Common costs that might be separate from hospital charges are for the surgeon, anesthetist, or other specialty care providers.
- ***MS-DRGs****:* Medicare Severity-Diagnosis Related Groups – A system used to categorize hospital inpatient procedures for patients receiving the same service and with similar clinical characteristics. Each MS-DRG is defined by a particular set of patient attributes including principal diagnosis, up to 24 additional diagnoses, up to 25 procedures, sex, age, and discharge status. MS-DRGs account for the severity of illness, expected level of care, and associated costs of care. This allows for meaningful comparisons of episode costs across states, regions, health systems, and populations.
- ***Outliers***: Cost outliers refer to values that do not reflect typical costs for a service, visit, or episode of care. Atypical costs may occur for reasons including incomplete data, human error, or extremely serious health care issues. Outlier values are either very high or very low relative to typical costs and could impact the accuracy and relevance of average cost estimates if not removed from the analysis.
- ***Paid per Visit****:* The paid per visit amount is calculated as the sum of the insurance paid amount and member paid amounts, divided by the number of visits to generate an average cost estimate. The insurance paid amount refers to the amount paid for the procedure or service by the insurer. The member paid amount refers to the sum of co-insurance, copay, and deductible amounts paid by the patient.
- ***Utilization per 1,000***: Utilization per 1,000 persons is an industry standard calculation that allows for normalized comparisons. This rate is calculated by summing the utilization (either claims or visits depending on the analysis) and dividing by the relevant number of members in the HCCD database. This provides an average per-individual utilization count which is then multiplied by 1,000.

- ***Visit***: Refers to a set of related claims for an individual on a specific date of service.

General Methodology Notes

Average Cost Comparisons: *CostAware* allows users to compare the average cost of medical procedures and episodes of care across Delaware hospitals and other care settings.

- Average costs for episodes of care including knee/hip replacement, C-section and vaginal birth can be compared across Delaware hospitals. Episodes are assigned to hospitals based on the billing provider's National Provider Identifier (NPI) as submitted on an inpatient claim.
- Average costs for common medical services can be compared across care settings including offices, clinics, telehealth visits, independent/free-standing facilities, and hospital outpatient departments. Care settings are identified using data submitted to DHIN by Delaware payers.

Outlier Methodology: Outliers refer to values that do not reflect typical costs for a service or episode of care and may occur for reasons including incomplete data, human error, or medically complex cases. Outlier values are either very high or low relative to typical costs and will impact the accuracy and relevance of average cost estimates if not removed from the analysis. Before calculating average costs, *CostAware* applies the following methods to remove outliers.

- Zero-dollar claims are removed because they are uncommon and the HCCD lacks complete information on uncompensated care.
- The remaining claims for each service or episode are grouped by provider (care setting, hospital) and insurance type (commercial insurance, Medicare Advantage, Medicaid).
    - Medical services are grouped based on care setting or the site where the service was provided. Care settings include offices, urgent care facilities, telehealth, home, hospital outpatient, hospital emergency department, ambulatory surgery center, renal dialysis center, and outpatient lab. Care settings are identified based on data in the claim files submitted to DHIN by Delaware payers.
    - Episodes of care are assigned to Delaware hospitals based on billing provider identifiers, e.g., National Provider Identifier, or NPI.
- For each provider-insurance type group, claims/episodes are ordered from highest to lowest cost. A percentile rank is applied to each cost in the ordered list. Claims/episodes with a cost equal to or below the 2.5 percentile rank and equal to or above the 97.5 percentile rank are removed from the analysis.
- With the outliers removed, average costs for each service or episode are calculated for each provider-insurance type group. This process generates average cost estimates that reflect typical costs and that can be meaningfully compared.

Out of State Residents: Results reported on *CostAware* reflect members or patients who live in Delaware; out-of-state residents are excluded.

Payer Information: Payers refers to and includes commercial health plans, Delaware Medicaid and Managed Care Organizations and Medicare Advantage Plans. Medicare Fee for Service (FFS) data will be added to *CostAware* when it becomes available. The following were excluded from *CostAware* measures because they do not provide comprehensive health care coverage: Medicare Supplemental (Medigap) plans, Qualified Medicare Beneficiaries (dually eligible members), and Vaccines for Children Recipients.

CostAware average cost estimates also exclude entities reporting only pharmacy claims (CVS, Express Scripts), health plans no longer operating in Delaware, and claims for members living out of state.

Risk Adjustment: Average costs for specific medical services and episodes of care presented on *CostAware* are not risk-adjusted. They are actual average costs calculated based on HCCD data as submitted to DHIN by Delaware health care payers. The Total Cost of Care (TCOC) measures are risk-adjusted using the Johns Hopkins Adjusted Clinical Groups (ACG)® System. This software models and predicts an individual's health over time using existing data from medical claims, electronic medical records, and demographics like age and gender. Risk adjustment considers all diagnoses and services received by a patient over a defined period and assigns a risk score for each person. With a health risk score assigned to each person, an average risk score can be calculated for each population subgroup being compared.

Methodology for Medical Services

CostAware includes estimates of average costs and service counts based on claims data from the Delaware Health Care Claims Database (HCCD) for 2019-2021. Calculations reflect data for Delaware residents and measures were generated for all payer types unless otherwise noted. Average cost estimates exclude denied claims and claims for services with a zero-dollar paid amount. A provider must have 30 or more claims for a particular service after outlier removal to support reliable estimates of average costs. Average cost estimates for medical services reflect the amounts paid on the claim line that includes the relevant Current Procedural Terminology (CPT) code.

Procedures Codes: Medical services reported on *CostAware* are identified based on American Medical Association (AMA) Current Procedural Terminology (CPT) codes. The CPT codes chosen are for common medical procedures and are not associated with complications or comorbidities. Individuals with clinical expertise were consulted to confirm code choices. The following CPT codes were used to identify the medical services reported on *CostAware.*

Service	Description	Procedure Code
Blood Tests	Blood Count: Complete (CBC) automated (Hgb, Hct, RBC, WBC, and platelet count) and automated differential WBC	85025
	Hemoglobin; glycosylated (A1C)	83036
	Hemoglobin, glycosylated (A1C) by device cleared by FDA for home use	83037
Cardiac-related	Electrocardiogram (ECG or EKG) With Report and Interpretation	93000
	Electrocardiogram (ECG or EKG) With Tracing	93005
	Electrocardiogram (ECG or EKG), Report and Interpretation Only	93010
	Cardiovascular stress test	93017
	Electrocardiogram (ECG or EKG) monitoring	93270
Colonoscopy	Colonoscopy without intervention	45378
	Colonoscopy with intervention	45380

Service	Description	Procedure Code
Diabetes-related	Glucose, quantitative, blood (except reagent strip)	82947
	Glucose, quantitative, blood, reagent strip	82948
	Glucose, quantitative, blood, post glucose dose (includes glucose)	82950
	Glucose, blood by glucose monitoring device(s) cleared by the FDA specifically for home use	82962
	Hemoglobin; glycosylated (A1c)	83036
	Hemoglobin, glycosylated (A1C) by device cleared by FDA for home use	83037
	Diabetes outpatient self-management training services, individual, per 30 minutes	G0108
	Diabetes outpatient self-management training services, group session (2 or more), per 30 minutes	G0109
Emergency Department Visits	ED Visit - Mild Severity	99281
	ED Visit - Mild Severity (expanded history and examination)	99282
	ED Visit - Medium Severity (expanded history and examination)	99283
	ED visit - Medium Severity (detailed history and examination)	99284
	ED visit - High Severity (comprehensive history and examination)	99285
Gallbladder Removal	Gallbladder Removal	47562
Head CT	Head CT - without contrast	70450
	Head CT - without contrast followed by contrast	70470
Lumbar Spine MRI	Lumbar Spine MRI - without contrast	72148
	Lumbar Spine MRI - with contrast	72158
Mental Health Services	Family Psychotherapy with Patient	90847
	Family Psychotherapy without Patient	90846
	Group Psychotherapy	90853
	Psychotherapy with Evaluation and Management, 45 Minutes with Patient	90836
	Psychotherapy, 30 Minutes with Patient	90832
	Psychotherapy, 45 Minutes with Patient	90834

Service	Description	Procedure Code
	Psychotherapy, 60 Minutes with Patient	90837
	Psychiatric Diagnostic Evaluation	90791
	Psychiatric Diagnostic Evaluation with medical services	90792
	Psychotherapy for crisis, the first 60 minutes	90839
Screening Mammography	Screening Mammography, bilateral (2-view study of each breast)	77067
Urine Tests	Bacterial Culture, Quantitative Colony Count	87086
	Urinalysis, Automated with Microscope Examination	81001
	Urinalysis, Manual Test	81002
	Urinalysis, Automated	81003
	Drug Screen	80307
Adult Wellness Visits	Office Visit, New Patient - moderate complexity, 45-59 minutes	99204
	Office Visit, New Patient - high complexity, 60-74 minutes	99205
	Office Visit, Established Patient - low complexity, 5 minutes	99211
	Office Visit, Established Patient - low complexity, 10-19 minutes	99212
	Office Visit, Established Patient - low complexity, 20-29 minutes	99213
	Office Visit, Established Patient - moderate complexity, 30-39 minutes	99214
	Office Visit, Established Patient - high complexity, 40-54 minutes	99215
Child Wellness Visits	New Patient Preventive Care Visit for Adolescent, Ages 12-17	99384
	New Patient Preventive Care Visit for Child, Ages 1-4	99382
	New Patient Preventive Care Visit for Child, Ages 5-11	99383
	New Patient Preventive Care Visit for Child, Under Age 1	99381
	Preventive Care Visit for Adolescent, Ages 12-17	99394
	Preventive Care Visit for Child, Under Age 1	99391
	Preventive Care Visit for Child, Ages 1-4	99392
	Preventive Care Visit for Child, Ages 5-11	99393

For individual services, the average cost was calculated based on the appropriate CPT code by payer type. Because individual services are coded separately, variation across payer types and care settings is relatively low. The average cost estimates do not include costs for other, unrelated services received by the patient on the same day or as part of the same visit. Average cost estimates are presented by payer type and can be compared across care settings to highlight variation in Delaware. Future versions of *CostAware* will add provider names within the care setting categories to support comparisons across individual providers.

Methodology for Episodes

Some medical procedures require multiple services from different providers and episode of care analysis combines the payments for these services to create a single estimate of average cost. *CostAware* presents estimates of average costs and the number of episodes performed by Delaware hospitals based on Health Care Claims Database (HCCD) data for calendar years 2019-2021. Calculations reflect services provided to Delaware residents and the measures were generated for all payer types unless otherwise noted. Average cost estimates exclude denied claims and episodes with a zero paid amount. The average cost per episode reflects claims for facility and professional services provided during the inpatient hospital stay, e.g., all services delivered between the admission and discharge dates. A hospital must have 11 or more claims for a particular episode to be included in the calculations to support reliable estimates of average costs.

Episodes were identified based on assignment of Medicare Severity-Diagnosis Related Groups (MS-DRGs) to hospital inpatient claims data using the 3M MS-DRG software. Procedures often have multiple MS-DRGs to reflect the presence (or absence) of Complications or Comorbidities or Major Complications or Comorbidities (CC / MCC) and other clinical differences. For purposes of *CostAware,* episodes were identified based on MS-DRGs without CC / MCC because these reflect typical patient experience and average costs. The following MS-DRGs were used to identify and define the episodes of care reported on *CostAware*.

Episodes	Codes and Description	MS-DRG
Cesarean-Section	Cesarean section with sterilization without CC / MCC	785
	Cesarean section without sterilization without CC / MCC	788
Knee and Hip Replacement	Revision of Hip or Knee Replacement without CC / MCC	468
	Major Joint Replacement or Reattachment of Lower Extremity Without MCC	470
Vaginal Delivery	Vaginal Delivery with Sterilization/D&C without CC / MCC	798
	Vaginal Delivery without Sterilization/D&C without CC / MCC	807

For episodes, average costs were estimated based on MS-DRG assignments and reflect multiple services associated with the procedure that were performed and billed during the inpatient hospital stay (e.g., between the admission and discharge dates) by payer type. Because episode cost estimates reflect

payments for multiple services and providers, variation across payer types and hospitals is generally larger than that for medical services.

MS-DRG assignments identify patients who had a particular episode (or procedure) on a particular date. Each episode is further identified by a "common key," which is a combination (or concatenation) of patient EID, date of service and place of service. This common key is used to identify claims for all services the patient received between the hospital admission and discharge dates. The cost of all services provided during this period are added together to generate a total cost estimate for each episode.

The common key is also used to assign episodes to payers (commercial insurance, Medicare Advantage, Medicaid) and to the hospital where the procedure was performed using National Provider Identifiers (NPIs). The outlier methodology is applied after episodes are assigned to hospitals and grouped by payer type. The total cost for episodes by hospital and payer is calculated and divided by the corresponding number of episodes to generate the average cost estimates. Results are reported on *CostAware* If 11 or more episodes remain after outlier removal for a particular payer-hospital combination.

Average cost estimates are presented by payer type, highlight variation in the Delaware health care marketplace, and can be compared across hospitals. The average cost estimates do not distinguish between what is paid to the hospital, physicians or other providers who treated the patient. Episodes for patients with multiple types of insurance coverage were excluded from the analysis to reduce the number and impact of low-cost outliers.

Methodology for Total Cost of Care (Update Coming Soon)

CostAware includes measures capturing variation in the average Total Cost of Care (TCOC) for patients attributed to Delaware Accountable Care Organizations (ACOs). In addition to estimates of the risk adjusted average TCOC (per member per month), the methodology generates index values that measure relative efficiency and the separate impacts of prices and service utilization. TCOC measures reflect all services delivered to patients on an annual basis regardless of care setting or provider type. These measures are based on claims data for commercially insured members, no Medicaid or Medicare Advantage claims are included in the analysis. Calculations reflect data for Delaware residents represented in the Health Care Claims Database (HCCD) for calendar years 2019-2021.

Patients were attributed to individual primary care practices based on their respective National Provider Identifiers (NPIs) to support calculation of the TCOC measures. Practices were then assigned to ACOs based on publicly available ACO practice rosters. ACO level *CostAware* measures were calculated as weighted averages of individual practice values using the number of attributed patients as weights. A methodology that supports more granular TCOC reporting will be developed in collaboration with Delaware payers and providers for future releases of *CostAware*. ACO groupings are also consistent with the CMS quality measures displayed on the *CostAware* website.

ACOs are groups of doctors, hospitals, and other health care providers, who come together voluntarily to provide coordinated, high-quality care for their patients. ACOs establish financial incentives for providers to promote best practice care to the right persons at the right time while improving patients' overall health care experience. The ACO initiative is a major piece in Delaware's Road to Value – a plan

to transform the way that health care is delivered and paid for in the state. For more information on the Road to Value, visit: https://www.choosehealthde.com/Road-to-Value.

HealthPartners: The HealthPartners Total Cost of Care (TCOC) methodology is person-based, population-centered, and facilitates meaningful comparisons of cost and efficiency in treating patients across states, regions, health systems, provider groups and other dimensions. The methodology was endorsed by the National Quality Forum (NQF) in 2012 and again in 2017 for application to commercial health plan claims data. HealthPartners is applied separately to pediatric and adult populations and generates measures of TCOC overall, by service category (Inpatient [IP], Outpatient [OP], Professional, and Prescriptions [Rx]) and finer levels of granularity. Specific metrics produced include Average TCOC (per member per month) and Total Cost, Resource Use, and Price Index scores that support comparisons on a risk-adjusted and attributed-patient basis. Detailed information on the HealthPartners TCOC methodology and measures can be found here: https://www.healthpartners.com/about/improving-healthcare/tcoc/.

Application of the HealthPartners TCOC measures requires:
Commercial health plan claims data that includes allowed amounts (defined as the sum of insurance payment + patient copay + coinsurance + deductible). Provider charged amounts cannot be used in the calculations. HCCD commercial claims data provided by DHIN includes the insurance payments, copay, coinsurance, and deductible amounts needed to calculate allowed amounts and was used to produce the measures reported on *CostAware.*
To attribute patients to primary care providers, practices and ACOs, DHIN applied an attribution methodology based on consensus criteria and specifications developed to support the work of the Delaware Primary Care Reform Collaborative (PCRC) and other state initiatives. The consensus criteria establish the codes used to identify primary care services, providers, and sites of care. Patients are attributed to the primary care provider they visited most frequently during a two-year (24-month) retrospective lookback period. In that case of a tie, the patient is attributed to the primary care provider they visited most recently.
Application of MS-DRGs: DHIN applied 3M MS-DRG software tools to HCCD hospital inpatient claims data.
Risk adjustment at the patient level. The NQF endorsement is based on use of the Johns Hopkins ACG® System which DHIN applied to HCCD patient-level data.

HealthPartners Measures reported by ACO on *CostAware*

TCOC Measures	Notes
Average Total Cost of Care (TCOC)	Risk-adjusted estimate of the average TCOC (per member per month) of treating patients attributed to a specific ACO. TCOC reflects services received by patients across all care settings and provider types and measures relative cost efficiency in treating patients.

TCOC Measures	Notes
Total Cost Index (TCI)	The TCI for a specific ACO facilitates comparisons to the average across all Delaware ACOs (benchmark). ACOs with a TCI > 1.0 have higher than average costs; ACOs with TCI < 1.0 have lower than average costs and may be more efficient in providing care to patients.
Resource Use Index (RUI)	Captures the impact of service utilization on TCOC. RUI > 1.0 indicates higher than average service utilization in caring for patients. RUI helps identify opportunities to reduce duplication of services and improve care coordination.
Price Index (PI)	Captures the impact of prices on TCOC. PI > 1.0 indicates higher than average prices or reimbursement rates for services. PI helps identify cost drivers and opportunities to reduce costs.

Quality Measures (Update Coming Soon)

Quality measures are tools that help measure or quantify healthcare processes, outcomes, patient perceptions, and organizational structure and/or systems associated with the provision of high-quality care and/or that relate to one or more quality goals for health care. These goals include: effective, safe, efficient, patient-centered, equitable, and timely care. This information can help consumers make better informed decisions about where to seek high-quality health care. *CostAware* includes publicly available quality measures for hospitals and Accountable Care Organizations (ACOs) generated and published by the Centers for Medicare and Medicaid Services (CMS) and Centers for Disease Control and Prevention (CDC). These sources are described in additional detail below.

Hospital Quality Measures

Patient Experience Measures: Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS). The Centers for Medicare and Medicaid Services (CMS) provide public information on patient perspectives of their hospital care collected through surveys. The CMS HCAHPS measures reported on *CostAware* are summarized in the table below. For more information, see: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/HospitalHCAHPS.

HCAHPS Response	HCAHPS Identifier	Notes	Included in CostAware 1.0
Nurses "always" communicated well	H_COMP_1_A_P	Patients who reported that their nurses "Always" communicated well	No

HCAHPS Response	HCAHPS Identifier	Notes	Included in CostAware 1.0
Doctors "always" communicated well	H_COMP_2_A_P	Patients who reported that their doctors "Always" communicated well	No
Patients "always" received help as soon as they wanted	H_COMP_3_A_P	Patients who reported that they "Always" received help as soon as they wanted	No
Patients who gave a rating of "9" or "10" (high)	H_HSP_RATING_9_10	Patients who gave their hospital a rating of 9 or 10 on a scale from 0 (lowest) to 10 (highest)	Yes
"YES", patients would definitely recommend the hospital	H_RECMND_DY	Patients who reported YES, they would definitely recommend the hospital	No

Safe Care: Healthcare Associated Infections. The Centers for Disease Control and Prevention (CDC) has developed and publishes measures that capture rates of Healthcare Associated Infections in hospitals. Data to generate these measures is collected through the National Healthcare Safety Network (NHSN). The CDC Healthcare Associated Infections measures reported on *CostAware* are summarized in the table below. For more information, see: https://www.cdc.gov/hai/data/index.html.

Measure Name	Measure Identifier	Included in CostAware 1.0
Central Line Associated Blood Stream Infection (CLABSI)	HAI_1_SIR	No
Methicillin-Resistant Staphylococcus Aureus - MRSA Bacteremia	HAI_5_SIR	No
Clostridium Difficile (C. Diff)	HAI_6_SIR	No

CMS Patient Safety Indicators (PSI): Complications and Deaths. The Centers for Medicare and Medicaid Services (CMS) provide public information on rates of complications and deaths occurring in hospitals. The PSIs were developed by clinical experts and reflect hospital quality of care for adult patients; many are endorsed by the National Quality Forum (NQF). *CostAware* includes CMS measures of the rates of elective deliveries, complications for hip and knee replacements, and readmissions after hip/knee replacement and hospital discharge. For more information on the CMS Patient Safety Indicators, see: https://qualitynet.cms.gov/inpatient/measures/psi.

Measure Name	Measure Identifier	Included in CostAware 1.0
Maternal Health – Elective Delivery	PC_01	Yes
Rate of Complications for Hip/Knee Replacement Patients	COMP_HIP_KNEE	Yes
Unplanned Visits – Rate of Readmission After Hip/Knee Replacement	READM_30_HIP_KNEE	No
Unplanned Visits – Rate of Readmission After Discharge from Hospital (hospital-wide)	READM_30_HOSP_WIDE	Yes

Accountable Care Organization Quality Measures

Medicare Shared Savings Program – The Shared Savings Program is a voluntary initiative that encourages groups of doctors, hospitals, and other health care providers to come together as an Accountable Care Organization (ACO) to provide coordinated, high-quality care to their Medicare beneficiaries. Participating ACOs must report quality data to CMS after the close of every performance period and quality performance is measured using standard methods. Quality measures span four domains: patient/caregiver experience, care coordination/patient safety, preventive health, and at-risk populations. Medicare Shared Savings Program quality measures for ACOs reported on *CostAware* are summarized in the table below. For more information on the Medicare Shared Saving Program, visit: https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/sharedsavingsprogram/program-data.

Measure Name	Measure Identifier	Included in CostAware 1.0?
Getting Timely Care, Appointments, and Information	CAHPS_1	Yes
Statin Therapy for the Prevention and Treatment of Cardiovascular Disease	QualityID_438	Yes
Depression Remission at Twelve Months	QualityID_370	Yes
Breast Cancer Screening	QualityID_112	Yes
Diabetes: Hemoglobin A1c (HbA1c) Poor Control (>9%), WI	QualityID_001_WI	Yes
Controlling High Blood Pressure, WI	QualityID_236_WI	No
Patients' Rating of Provider	CAHPS_3	No
Hospital-Wide 30-Day Readmission Rate	Measure_479	No

Measure Name	Measure Identifier	Included in CostAware 1.0?
Screening for Depression and Follow-up Plan	QualityID_134_WI	No
Colorectal Cancer Screening	QualityID_113	No

Data Quality for the Health Care Claims Database

DHIN manages quality assurance processes throughout the data life cycle and reviews quality before files are ingested, following application of each data enhancement, and prior to use by analysts. Beginning with monthly claims data submissions, a 5-step data validation process occurs over several weeks. Incoming files are checked for integrity and compliance with specifications, values are assessed for reasonableness, and specific validations are performed for each data enhancement applied. All outputs and results based on analysis of HCCD data, including CostAware measures, are subjected to a final quality evaluation prior to release. These quality assessments are conducted by a team of analysts, claims data experts, and a medical doctor. Automated processes are used to aid in the calculation of data quality measures, creation of reports, and review of results. National and regional data sources are consulted in assessing the reasonableness of outcomes where available and appropriate.

5 Step Data Submission Validation Process

The 5-step data submission validation process includes: Staging, Level 1, Claims Versioning, Level 2, and Data Enhancements; the focus of each step is listed in the table below. If any step identifies invalid or unexpected results, DHIN and the payer collaborate to understand and reconcile the issue impacting the unexpected result. Most issues can be explained due to normal variation in the claims data. Sometimes data must be corrected and resubmitted by the payer to address a data quality issue. These data quality processes produce accurate and stable claims data within 90 days of health care events represented in submitted claims.

Staging	Level 1	Versioning	Level 2	Data Enhancements	Analytic Warehouse
File Integrity • File reconciliation • Processing viability	File Specification Compliance • Data type • Format • String length • Code sets • % complete • Orphaned claims	Many Adjudications to one claim • Medical • Pharmacy	Reasonableness Check • Descriptive statistics • Distributions • Critical reporting elements • National and state comparisons	Calculated Elements (open source and proprietary) • Age groups • Care settings • Johns Hopkins ACG risk score • Episode grouper • 3M MS-DRG	Move to Production

Validating the Data Enhancements

Application of data enhancements occurs prior to the 5th step of the data quality process. The purpose of the enhancements is to expand the availability of calculated elements with repeatable, reliable, and consistent results for all HCCD data. DHIN applies both open-source and proprietary enhancements to the HCCD data. Open-source enhancements include calculated data elements like age groups, service types, time periods, length of stay and other groupings. The patient attribution to primary care provider enhancement is consistent with parameters developed by Delaware's Primary Care Reform Collaborative.

The DHIN Analytics team also leveraged proprietary enhancements including the Johns Hopkins University ACG® System, 3M MS-DRG episode grouper (a component of the 3M™ Core Grouping Software), and the HealthPartners' Total Cost of Care and Resource Use Framework (TCOC) to develop inputs to generate the *CostAware* measures. To complete each set of enhancement output files, a data engineer followed the instructions provided by the software developer to install the required software and extract input data files from the HCCD according to vendor specifications using Amazon Redshift.

The data engineer created the input files based on the developer's instructions by aggregating the member eligibility, pharmacy, medical claim, and provider data and capturing primary diagnoses, admission and discharge dates, date of service through, date of service from, procedure codes, cost or reimbursement data, patient EID, and provider NPI number. Once the input files were created according to specifications, the data engineer uploaded the input files to the enhancement software (MS-DRG, ACGs, HealthPartners) to generate output files which in turn were used as inputs to produce the *CostAware* measures and reports.

After the output files were generated, Quality Assurance analysts followed a QA checklist to review the output files and compare results against expected values based on validation criteria established by the software developers. Examples of validation steps performed by the QA analysts included:

- Researching instances where a discharge date is not associated with an admission date suggesting the patient may not have undergone an inpatient procedure.
- Ensuring that episodes assigned an MS-DRG had valid admission and discharge dates to support accurate calculations of associated costs.
- Confirming that weighted values used and produced by the ACG and HealthPartners tools are assigned correctly to records in the output files and that results are within expected ranges.
- Identifying records that should be removed from the input files due to missing or incomplete data, invalid procedure or diagnosis codes, or secondary payer claim status.
- Validating the accuracy of enhancement outputs against direct queries of the HCCD data and verifying that key values align across platforms and are within expected ranges.
- Validating enhancement output files against external sources to ensure consistency with similar analysis projects and established industry benchmarks (e.g., verify that results based on HCCD data align with the distribution of DRGs in other databases).

Validating the Cost Measure Output

All output was reviewed for consistency and quality by multiple data analysts before and after being displayed on the *CostAware* site. Structured Query Language or SQL code used to extract the data needed to calculate *CostAware* measures from enhancement output files and the HCCD was reviewed by multiple project analysts to ensure accuracy. The reasonableness of measure outputs was assessed by comparing values to results generated based on other sources of similar information and established benchmarks when available. When suspected anomalies were identified, investigation into potential causes was performed and corrections applied where appropriate. Measures were also compared to similar results generated based on direct queries of the HCCD database to assess alignment and the reasonableness of values.

Quality processes, beginning with 5-step data submission validation and continuing through application of data enhancements and generation of *CostAware* measures, is absolutely necessary. Claims data quality and completeness are impacted by factors including changes in providers, payers, and data systems. Repeatable and reliable data quality processes identify issues early and enable corrections before the data are used to support reporting or decision-making. They ensure that analytic results based on the HCCD accurately reflect health care spending, utilization, and quality in Delaware. Careful attention to data quality supports accurate reporting on the cost of health care services for state residents. In turn, health care cost and quality transparency assists Delaware in identifying opportunities for health system performance improvement and in making evidenced-based policy decisions.